

# TEST REPORT

|                        |                                                                                |
|------------------------|--------------------------------------------------------------------------------|
| EUT Description        | Integrated Device                                                              |
| Brand Name             | CINTERION ELS81-US                                                             |
| Model Name             | ELS81-US                                                                       |
| FCC/IC ID              | FCC ID: QIPELS81-US                                                            |
| Date of Test Start/End | 2018-09-27 / 2018-10-05                                                        |
| Features               | <b>WWAN:</b><br><b>UMTS: II,IV,V</b><br><b>LTE:2,4,5,12</b><br>(see section 1) |

|                       |                                          |
|-----------------------|------------------------------------------|
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|                     |                                                        |
|---------------------|--------------------------------------------------------|
| Reference Standards | FCC CFR Title 47 Part 2, 22, 24, 27<br>(see section 1) |
|---------------------|--------------------------------------------------------|

|                            |                                                                                                                  |
|----------------------------|------------------------------------------------------------------------------------------------------------------|
| Test Report identification | 180810-02.TR02                                                                                                   |
| Revision Control           | <b>Rev. 01</b><br><b>This test report revision replaces any previous test report revision</b><br>(see section 8) |

The test results relate only to the samples tested.  
The test report shall not be reproduced in full, without written approval of the laboratory.

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## 1. Standards, reference documents and applicable test methods

1. FCC 47 CFR part 2 - Subpart J - Equipment Authorization Procedures.
2. FCC 47 CFR part 22 - Subpart H - Cellular Radiotelephone Service.
3. FCC 47 CFR part 24 – Subpart E - Broadband PCS.
4. FCC 47 CFR part 27 – Subpart C - Technical Standards.
5. FCC 47 CFR part 27 – Subpart L - 1695-1710, 1710-1755 MHz, 1755-1780 MHz, 2110-2155 MHz, 2155-2180 MHz, 2180-2200 MHz Bands.
6. FCC OET KDB 971168 D01 v03r01 Measurement guidance for certification of licensed digital transmitters.
7. C63.26-2015 - IEEE/ANSI Standard for Compliance Testing of Transmitters Used in Licensed Radio Services.

## 2. General conditions, competences and guarantees

- ✓ Intel Corporation SAS Wireless RF Lab (Intel WRF Lab) is an ISO/IEC 17025:2005 testing laboratory accredited by the American Association for Laboratory Accreditation (A2LA) with the certificate number 3478.01.
- ✓ Intel Corporation SAS Wireless RF Lab (Intel WRF Lab) is an Accredited Test Firm recognized by the FCC, with Designation Number FR0011.
- ✓ Intel Corporation SAS Wireless RF Lab (Intel WRF Lab) is a registered Test site listed by the IC, with IC Assigned Code 1000Y.
- ✓ Intel WRF Lab only provides testing services and is committed to providing reliable, unbiased test results and interpretations.
- ✓ Intel WRF Lab is liable to the client for the maintenance of the confidentiality of all information related to the item under test and the results of the test.
- ✓ Intel WRF Lab has developed calibration and proficiency programs for its measurement equipment to ensure correlated and reliable results to its customers.
- ✓ This report is only referred to the item that has undergone the test.
- ✓ This report does not imply an approval of the product by the Certification Bodies or competent Authorities.

## 3. Environmental Conditions

- ✓ At the site where the measurements were performed the following limits were not exceeded during the tests:

|             |            |
|-------------|------------|
| Temperature | 24°C ± 3°C |
| Humidity    | 50% ± 5%   |

#### 4. Test samples

| Sample | Control #     | Description    | Model      | Serial #        | Date of receipt | Note    |
|--------|---------------|----------------|------------|-----------------|-----------------|---------|
| #01    | 180810-01.S01 | PC NUC         | NUC7I7DNKE | BTDN825001AC    | 2018-08-20      | PC      |
|        | 171018-01.S06 | RF Module US   | ELS81-US   | 004401082442910 | 2018-07-31      | Module  |
|        | 171018-01.S01 | Tekfun Antenna | W50-S-V4   | -               | 2017-10-17      | Antenna |
|        | 171018-01.S01 | Tekfun Antenna | W50-S-V4   | -               | 2017-10-17      | Antenna |

#### 5. EUT Features

|                        |                                                                                                                                                                                                                                                                                                                                                                                                                  |
|------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Brand Name             | CINTERION ELS81-US                                                                                                                                                                                                                                                                                                                                                                                               |
| Model Name             | ELS81-US                                                                                                                                                                                                                                                                                                                                                                                                         |
| FCC/IC ID              | FCC ID: QIPELS81-US                                                                                                                                                                                                                                                                                                                                                                                              |
| Software Version       | NA                                                                                                                                                                                                                                                                                                                                                                                                               |
| Driver Version         | 4.19.0.0                                                                                                                                                                                                                                                                                                                                                                                                         |
| Prototype / Production | Production                                                                                                                                                                                                                                                                                                                                                                                                       |
| Supported Radios       | <div> <div>GSM</div> <div>850 (824.2 – 848.8 MHz)<br/>1900 (1880 – 1909.8 MHz)</div> </div> <div> <div>WCDMA / HSPA+</div> <div>FDD II (1850.0 – 1910.0 MHz)<br/>FDD IV (1710.0 – 1755.0 MHz)<br/>FDD V (824.0 – 849.0 MHz)</div> </div> <div> <div>LTE FDD</div> <div>Band 2 (1850.0 – 1910.0 MHz)<br/>Band 4 (1710.0 – 1755.0 MHz)<br/>Band 5 (824.0 – 849.0 MHz)<br/>Band 12 (699 MHz – 716 MHz)</div> </div> |
| Antenna Information    | According to the manufacturer, the integrated device used external antennas connected at the rear of the device. Main and div antennas are 90° apart and tilted 45° from the middle of the device giving form to a “V” shape                                                                                                                                                                                     |

#### 6. Remarks and comments

- As per applicant request. The Testing was performed in the highest order RAT supported by the device.

## 7. LTE Test Verdicts summary

| Band  | FCC part             | Test name                  | Verdict |
|-------|----------------------|----------------------------|---------|
| LTE2  | 24.238               | Radiated spurious emission | P       |
| LTE4  | 27.53, 2.1053        | Radiated spurious emission | P       |
| LTE 5 | 22.917, 2.1053       | Radiated spurious emission | P       |
| LTE12 | 27.53 (g),<br>2.1053 | Radiated spurious emission | P       |

P: Pass

F: Fail

NM: Not Measured

NA: Not Applicable

## 8. Document Revision History

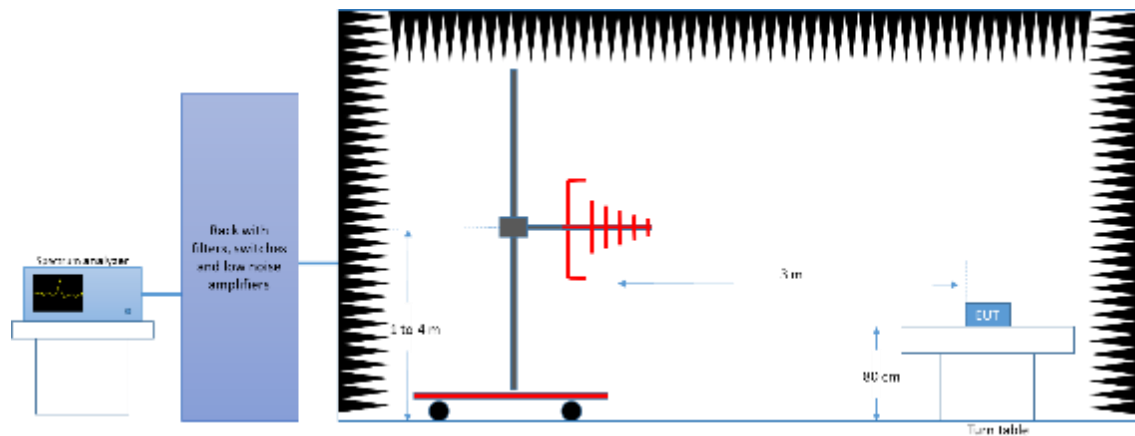
| Revision # | Date       | Modified by | Revision Details                                                   |
|------------|------------|-------------|--------------------------------------------------------------------|
| Rev. 00    | 2018-10-01 | F. Sauvan   | First Issue                                                        |
| Rev. 01    | 2019-05-06 | I. Kharrat  | Applicant information update<br>ISED recognition statement removed |
| Rev.02     | 2019-08-23 | I. Kharrat  | Applicant information update<br>ISED recognition statement added   |

# Annex A. Test & System Description

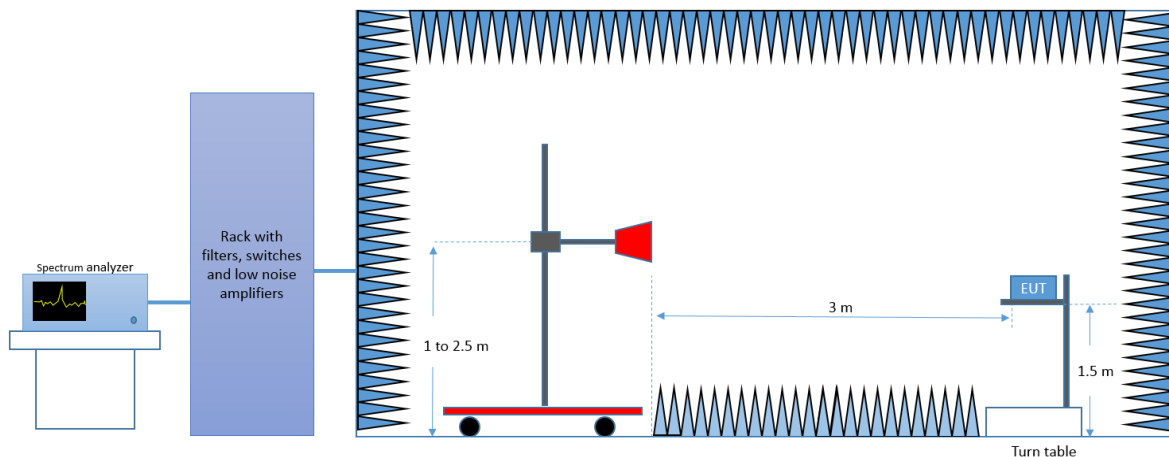
## A.1 Measurement System

Measurements were performed using the following setups. A communication tester was used to establish a communication link with the EUT, and the communication tester parameters were set to get the maximum output power from the EUT.

### *Radiated Setup 30MHz- 1GHz*



### *Radiated Setup Frequency range 1 GHz to 18 GHz*



## A.2 Test Equipment List

### A.2.1 Radiated Setup #1

| ID#  | Device                              | Type/Model | Serial # | Manufacturer    | Cal. Date  | Cal. Due Date |
|------|-------------------------------------|------------|----------|-----------------|------------|---------------|
| 0420 | Spectrum analyzer                   | FSV40      | 101556   | Rohde & Schwarz | 2018-05-17 | 2020-05-17    |
| 0137 | BiConiLog antenna<br>26 MHz – 6 GHz | 3142E      | 00156946 | ETS Lindgren    | 2017-12-19 | 2019-12-19    |
| 0135 | Semi Anechoic chamber               | FACT 3     | 5720     | ETS Lindgren    | 2018-04-18 | 2020-04-18    |
| 0329 | Measurement Software                | EMC32      | 100401   | Rohde & Schwarz | N/A        | N/A           |
| 0210 | Communication tester                | CMW500     | 147712   | Rohde & Schwarz | N/A        | N/A           |

### A.2.2 Radiated Setup #2

| ID#  | Device                         | Type/Model | Serial # | Manufacturer    | Cal. Date  | Cal. Due Date |
|------|--------------------------------|------------|----------|-----------------|------------|---------------|
| 0133 | Spectrum analyzer              | FSV40      | 101358   | Rohde & Schwarz | 2018-04-11 | 2020-04-11    |
| 0138 | Horn antenna<br>1 GHz – 18 GHz | 3117       | 00152266 | ETS Lindgren    | 2018-03-29 | 2020-03-29    |
| 0337 | Full Anechoic chamber          | RFD_FA_100 | 5996     | ETS Lindgren    | 2018-04-30 | 2020-04-30    |
| 0530 | Measurement Software           | EMC32      | 100623   | Rohde & Schwarz | N/A        | N/A           |
| 0311 | Communication tester           | CMW500     | 152720   | Rohde & Schwarz | 2018-04-16 | 2020-04-16    |

## A.3 Measurement Uncertainty Evaluation

The system uncertainty evaluation is shown in the below table:

| Measurement type            | Uncertainty [ $\pm$ dB] |
|-----------------------------|-------------------------|
| Radiated test < 1GHz        | $\pm 3.8$               |
| Radiated test 1GHz - 18 GHz | $\pm 4.7$               |

#### A.4 Conducted power

The tests were performed using the following conducted powers at the antenna terminal.

| Band     | Channel# | Frequency (MHz) | Conducted power (dBm) |
|----------|----------|-----------------|-----------------------|
| WCDMA II | 9262     | 1852.4          | 23.05                 |
|          | 9400     | 1880            | 22.98                 |
|          | 9538     | 1907.6          | 23.25                 |
| WCDMA IV | 4132     | 826.4           | 23.08                 |
|          | 4183     | 836.6           | 22.99                 |
|          | 4233     | 846.6           | 22.91                 |
| WCDMA V  | 1312     | 1712.4          | 23.15                 |
|          | 1413     | 1732.6          | 23.32                 |
|          | 1513     | 1752.6          | 23.30                 |
| LTE 2    | 18650    | 1711.58         | 22.60                 |
|          | 18900    | 1732.5          | 22.41                 |
|          | 19150    | 1753.42         | 22.25                 |
| LTE 4    | 20000    | 1711.58         | 22.80                 |
|          | 20175    | 1732.5          | 22.41                 |
|          | 20350    | 1753.42         | 22.37                 |
| LTE 5    | 20450    | 829             | 23.09                 |
|          | 20525    | 836.5           | 22.77                 |
|          | 20600    | 844             | 22.64                 |
| LTE 12   | 23035    | 699.97          | 23.06                 |
|          | 23095    | 707.41          | 22.86                 |
|          | 23155    | 715.03          | 22.83                 |



## Annex B. Test Results

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### B.1 Radiated spurious emission

#### B.1.1 Standard references

| BAND   | FCC part          | Limits                                                                                                                                                                          |
|--------|-------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| LTE 2  | 2. 1051, 24.238   | The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least $43 + 10 \log(P)$ dB |
| LTE 4  | 2. 1051, 27.53    | The power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) in watts by at least $43 + 10 \log_{10}(P)$ dB               |
| LTE 5  | 2. 1051, 22.917   | The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least $43 + 10 \log(P)$ dB |
| LTE 12 | 2.1051, 27.53 (g) | The power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) in watts by at least $43 + 10 \log_{10}(P)$ dB               |

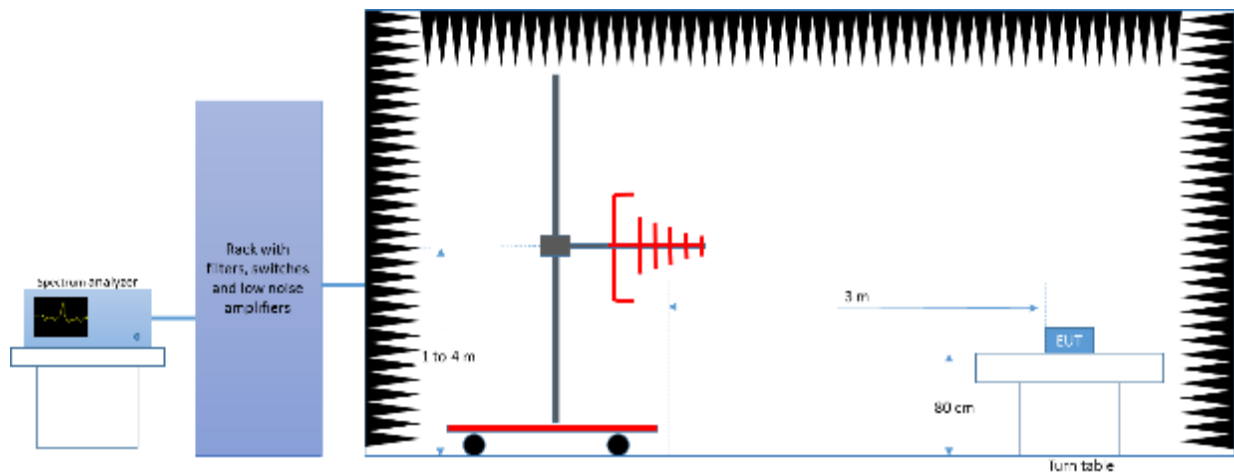
## B.1.2 Test procedure

The setup below was used to measure the radiated spurious emissions. The test was done following the FCC OET KDB 971168 D01 v03r01.

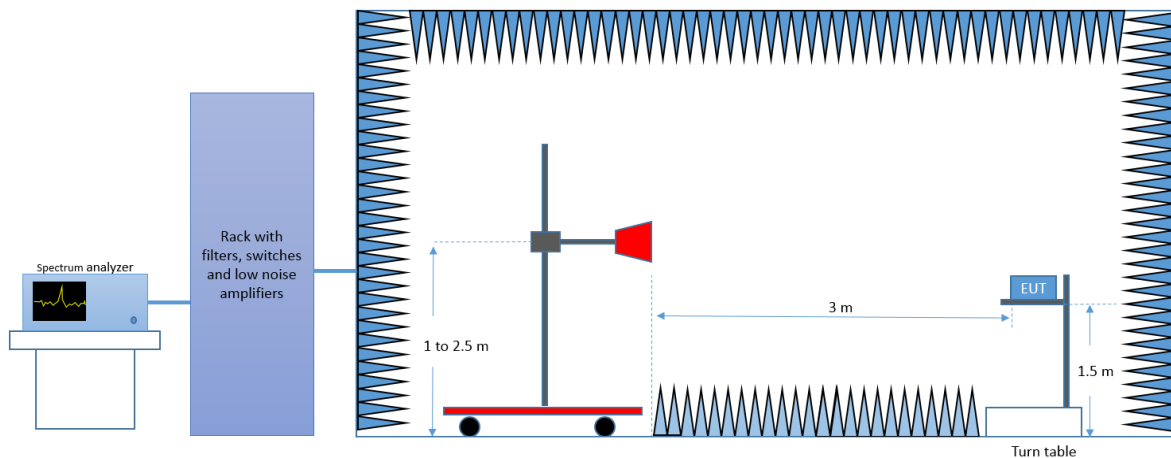
Depending of the frequency range and bands being tested, different antennas and filters were used.

The final measurement is done by varying the antenna height from 1 to 4 meters, the EUT azimuth over 360° and for both Vertical and Horizontal polarizations.

### *Radiated Setup 30MHz- 1GHz*



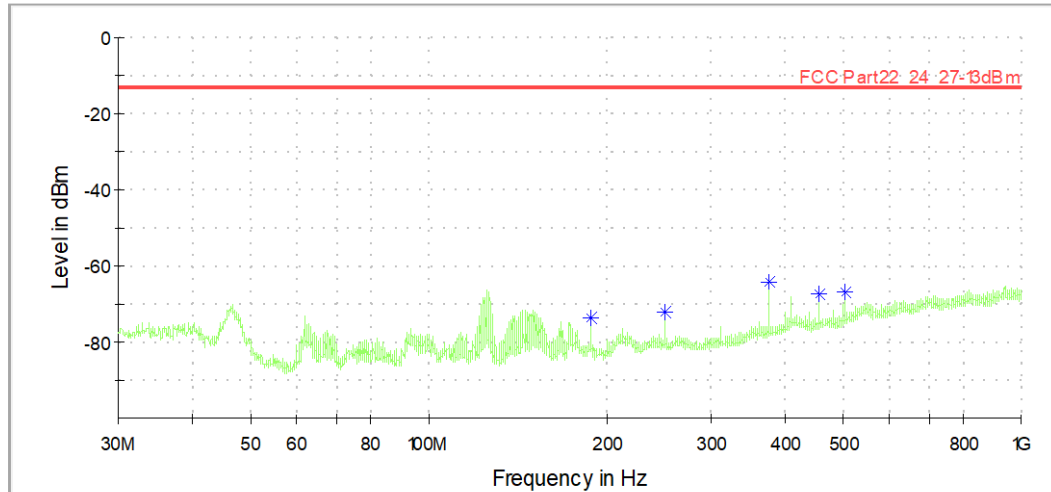
### *Radiated Setup Frequency range 1 GHz to 18 GHz*



### B.1.3 Test Results

#### LTE 2

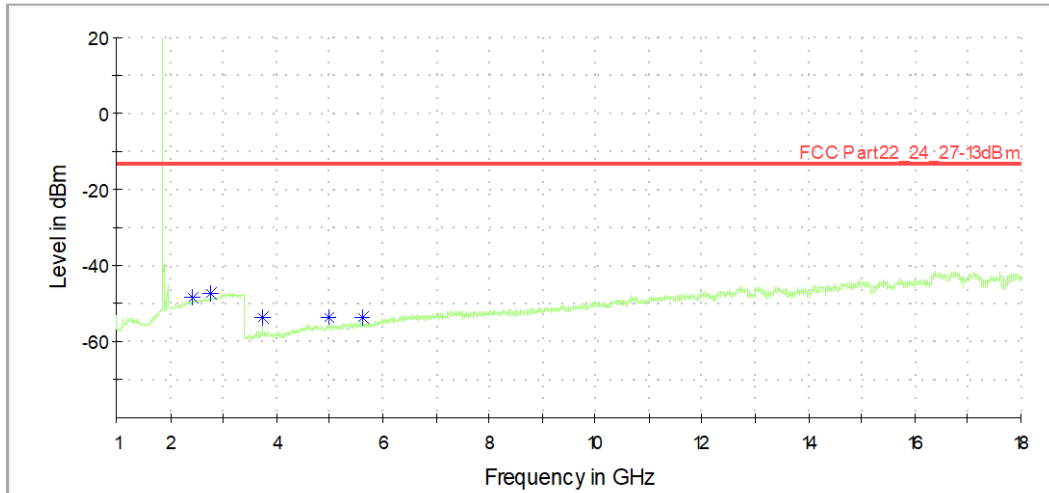
#### 30MHz to 1GHz - Radiated Spurious LTE 2 - QPSK - Mid channel 18900


 RMS measurements

 Limit FCC

| Frequency | RMS   | Limit | Margin |
|-----------|-------|-------|--------|
| MHz       | dBm   | dBm   | dB     |
| 187.5     | -73.5 | -13.0 | 60.5   |
| 250.0     | -72.0 | -13.0 | 59.0   |
| 375.0     | -64.2 | -13.0 | 51.2   |
| 456.0     | -67.2 | -13.0 | 54.2   |
| 504.0     | -66.8 | -13.0 | 53.8   |

# 1GHz to 18GHz - Radiated Spurious LTE 2 - QPSK - Mid channel 18900



RMS measurements

Limit FCC

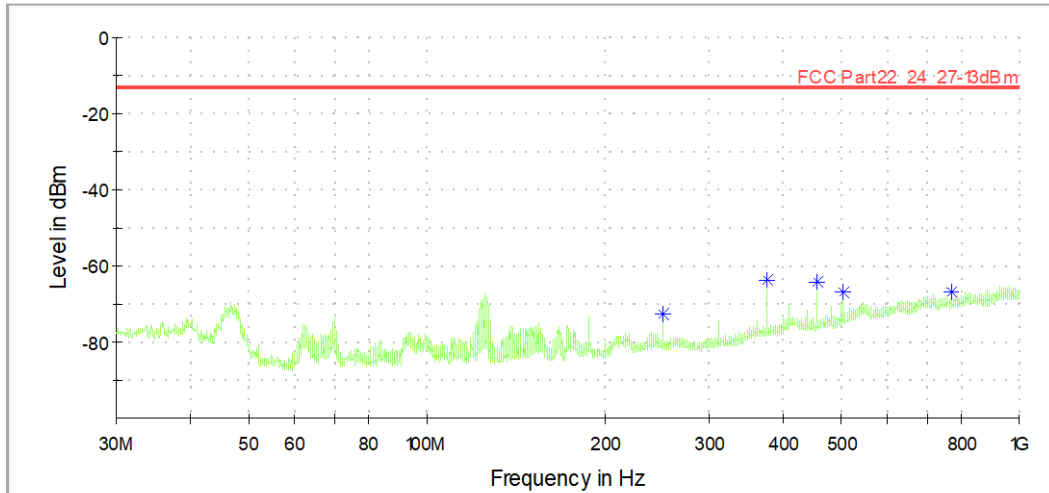
| Frequency | RMS   | Limit | Margin |
|-----------|-------|-------|--------|
| MHz       | dBm   | dBm   | dB     |
| 2440.5    | -48.6 | -13.0 | 35.6   |
| 2774.5    | -47.1 | -13.0 | 34.1   |
| 3760.0    | -53.6 | -13.0 | 40.6   |
| 4981.8    | -53.5 | -13.0 | 40.5   |
| 5640.2    | -53.9 | -13.0 | 40.9   |

Note1: the peak showed above the limit is the fundamental emission

Note2: the peak at 1960MHz corresponds to the downlink frequency

## LTE 4

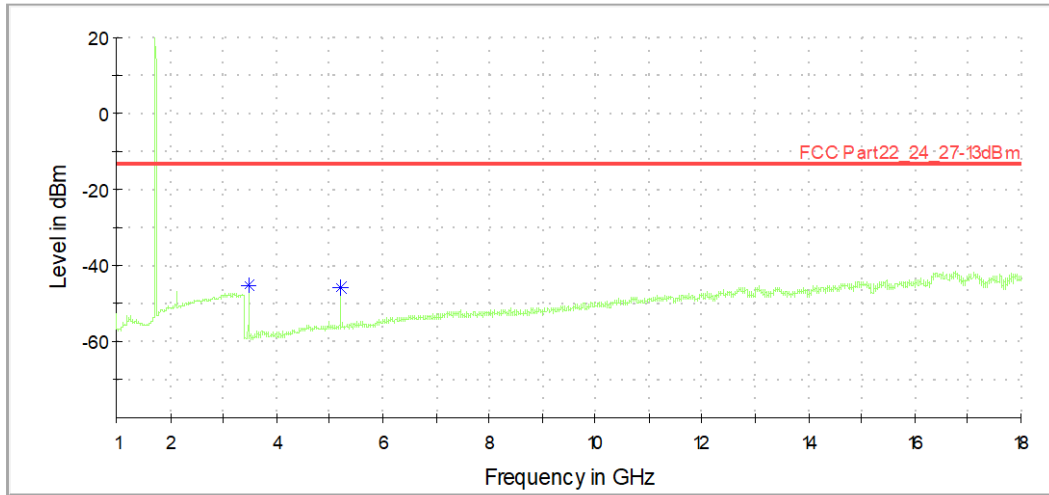
### 30MHz to 1GHz - Radiated Spurious LTE 4 - QPSK - Mid channel 20175



RMS measurements Limit FCC

| Frequency | RMS   | Limit | Margin |
|-----------|-------|-------|--------|
| MHz       | dBm   | dBm   | dB     |
| 250.0     | -72.5 | -13.0 | 59.5   |
| 375.0     | -63.9 | -13.0 | 50.9   |
| 456.0     | -64.3 | -13.0 | 51.3   |
| 504.0     | -66.9 | -13.0 | 53.9   |
| 770.1     | -66.7 | -13.0 | 53.7   |

# 1GHz to 18GHz - Radiated Spurious LTE 4 - QPSK - Mid channel 20175



— RMS measurements
 — Limit FCC

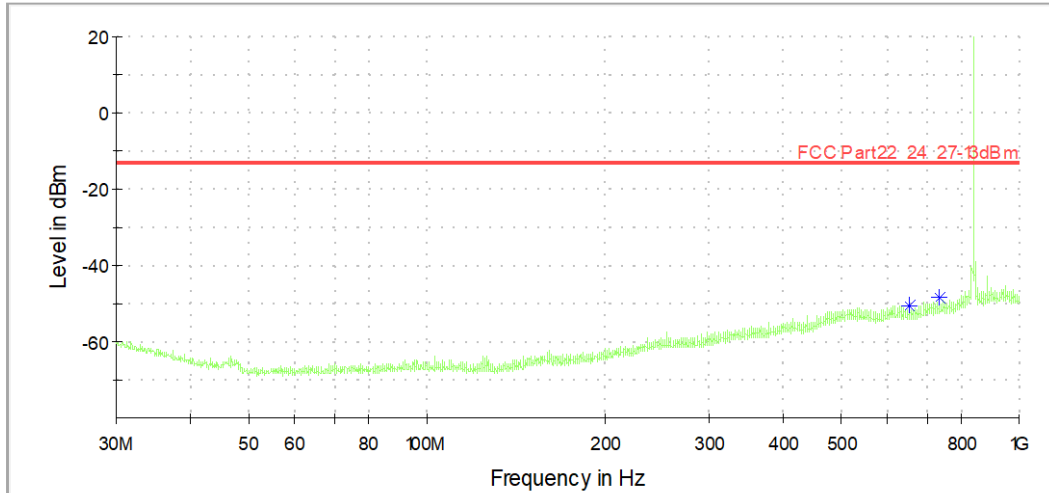
| Frequency | RMS   | Limit | Margin |
|-----------|-------|-------|--------|
| MHz       | dBm   | dBm   | dB     |
| 3464.8    | -45.2 | -13.0 | 32.2   |
| 5197.6    | -45.7 | -13.0 | 32.7   |

Note1: the peak showed above the limit is the fundamental emission

Note2: the peak at 2132.5MHz corresponds to the downlink frequency

## LTE 5

### 30MHz to 1GHz - Radiated Spurious LTE 5 - QPSK - Mid channel 20525

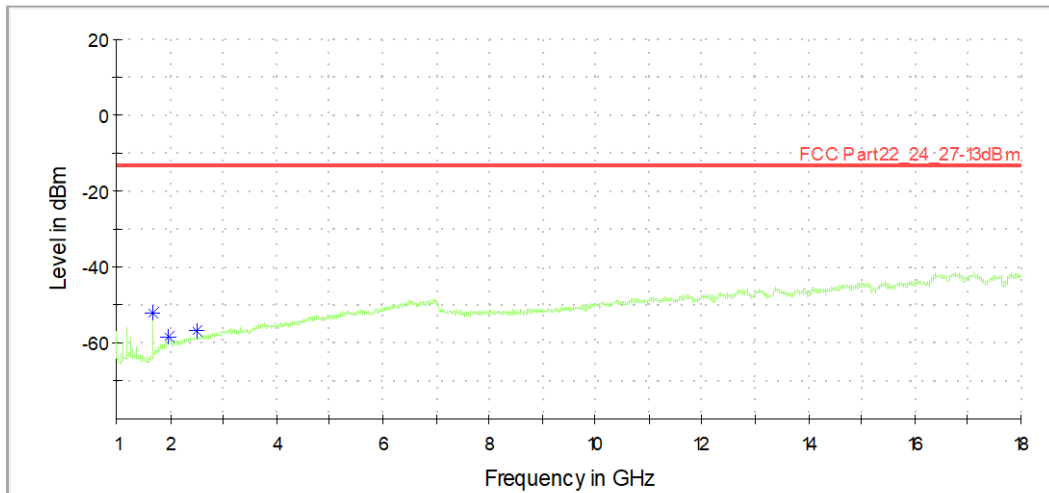


— RMS measurements — Limit FCC

| Frequency | RMS   | Limit | Margin |
|-----------|-------|-------|--------|
| MHz       | dBm   | dBm   | dB     |
| 651.0     | -50.5 | -13.0 | 37.5   |
| 735.2     | -48.6 | -13.0 | 35.6   |

Note1: the peak showed above the limit is the fundamental emission  
Note2: the peak at 881.5MHz corresponds to the downlink frequency

# 1GHz to 18GHz - Radiated Spurious LTE 5 - QPSK - Mid channel 20525



RMS measurements

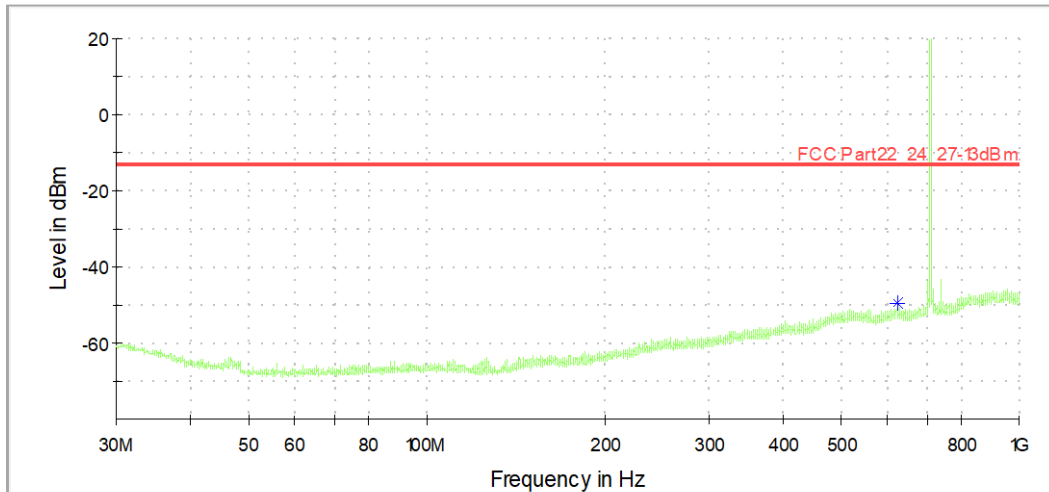
Limit FCC

| Frequency | RMS   | Limit | Margin |
|-----------|-------|-------|--------|
| MHz       | dBm   | dBm   | dB     |
| 1673.0    | -52.2 | -13.0 | 39.2   |
| 1995.0    | -58.3 | -13.0 | 45.3   |
| 2509.5    | -56.6 | -13.0 | 43.6   |



## LTE 12

### 30MHz to 1GHz - Radiated Spurious LTE 12 - QPSK - Mid channel 23095



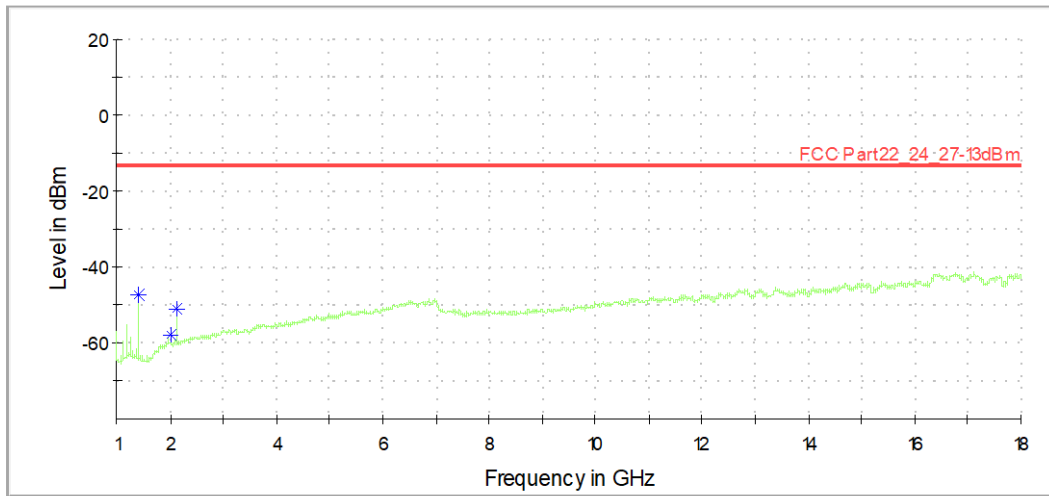
— RMS measurements — Limit FCC

| Frequency | RMS   | Limit | Margin |
|-----------|-------|-------|--------|
| MHz       | dBm   | dBm   | dB     |
| 622.8     | -49.7 | -13.0 | 36.7   |

Note1: the peak showed above the limit is the fundamental emission

Note2: the peak at 737.5MHz corresponds to the downlink frequency

# 1GHz to 18GHz - Radiated Spurious LTE 12 - QPSK - Mid channel 23095

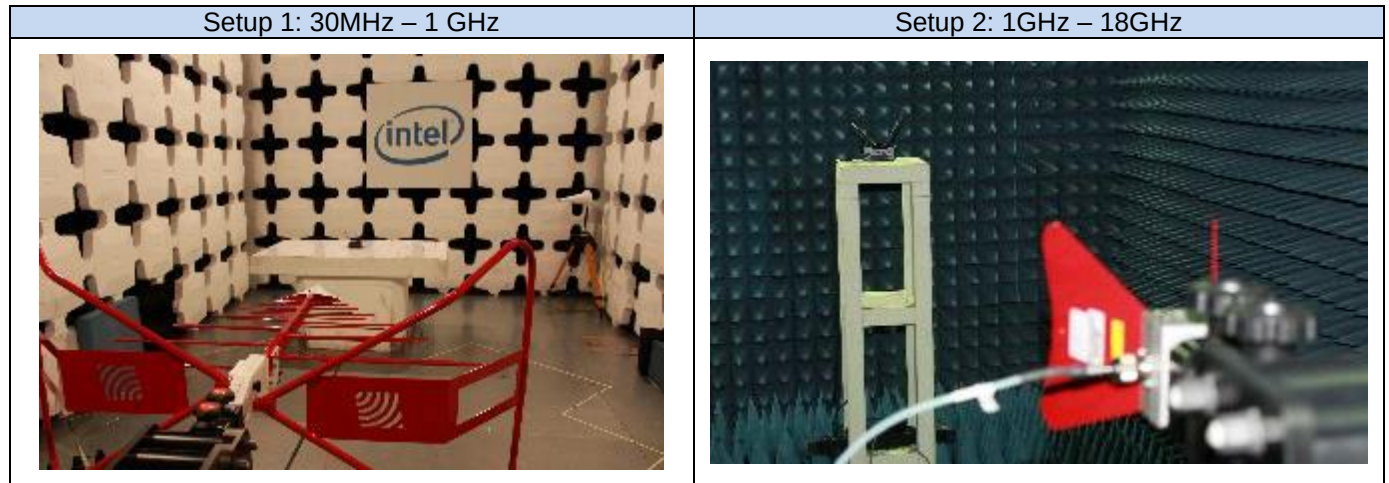


— RMS measurements
 — Limit FCC

| Frequency | RMS   | Limit | Margin |
|-----------|-------|-------|--------|
| MHz       | dBm   | dBm   | dB     |
| 1415.0    | -47.1 | -13.0 | 34.1   |
| 1997.5    | -58.0 | -13.0 | 45.0   |
| 2122.5    | -51.3 | -13.0 | 38.3   |

# Annex C. Photographs

## C.1 Radiated Test Setup



## C.2 Test Sample

Sample #01

